



A.D. 1873, 15th FEBRUARY. N° 570.

Treating Excreta.

LETTERS PATENT to Henry Young Darracott Scott, of Ealing, in the County of Middlesex, Major-General, C.B., for the Invention of "IMPROVEMENTS IN THE DEODORIZATION OF EXCRETA AND IN THE MANUFACTURE OF MANURES THEREFROM."

Sealed the 5th August 1873, and dated the 15th February 1873.

PROVISIONAL SPECIFICATION left by the said Henry Young Darracott Scott at the Office of the Commissioners of Patents, with his Petition, on the 15th February 1873.

I, HENRY YOUNG DARRACOTT SCOTT, of Ealing, in the County of Middlesex, Major-General, C.B., do hereby declare the nature of the said Invention for "IMPROVEMENTS IN THE DEODORIZATION OF EXCRETA AND IN THE MANUFACTURE OF MANURES THEREFROM," to be as follows:—

The object of this Invention is the prevention of nuisance in dealing with night soil and urinous liquids, and the fixation of their fertilizing elements, so as to render them valuable marketable commodities.

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In carrying out my Invention with night soil I endeavour, as far as possible, to separate the solids from the liquids and to extract from the liquid the phosphoric acid and nitrogen present by means of compounds, such as lime or magnesia and phosphate of magnesia.

For purposes of deodorization I employ dried sewage deposit, dried 5 earth, burnt clay, town ashes, saw dust, charcoal, or other deodorants and absorbents.

In order to arrest the fertilizing elements I employ lime filters which will decompose the soluble phosphates and retain their phosphoric acid. The lime filters will also decompose the nitrogenous compounds of the 10 urine which pass through them with the production of ammonia. Below the lime filters I employ filters of hydrated phosphate of magnesia, which will arrest the ammonia (produced by the lime) in the form of ammoniacal phosphate of magnesia. This process may be used for treating night soil either in the cesspool or other receptacle, or after it 15 has been removed therefrom. I sometimes pass the liquid portions through more than one set of filters, and for the purpose of more complete purification I add thereto filters of charcoal. One mode of applying my Invention to cesspools or middens for instance is as follows:—I form in or above the floor of the cesspool a chamber into 20 and through which the liquid can flow. In this I place a layer of lime in a granulated condition. This layer may be covered with cocoa-nut matting, horse hair, cloth, or canvas, and may be preserved from injury by means of a perforated metal screen or plate, over which I spread a layer of hydrated phosphate of magnesia and over this a layer of sewage 25 lime. Another protecting plate may be placed on this lime, and on it is spread a layer of charcoal. The cesspool or midden when charged as above is ready for use. The liquid portions of the soil, when deprived of their fertilizing elements, may then be allowed to pass off. Filters of like substances are also applicable to the retention of the fertilising 30 elements of the urine from public urinals and from stables and other nitrogenous foul waters.

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SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Henry Young Darracott Scott in the Great Seal Patent Office on the 15th August 1873.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, HENRY
5 YOUNG DARRACOTT SCOTT, of Ealing, in the County of Middlesex, Major-General, C.B., send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Fifteenth day of February, in the year of our Lord One thousand eight hundred and seventy-three, in the thirty-
10 sixth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Henry Young Darracott Scott, Her special licence that I, the said Henry Young Darracott Scott, my executors, administrators, and assigns, or such others as I, the said Henry Young Darracott Scott, my executors, administrators, and assigns, should at any
15 time agree with, and no others, from time to time and at all times thereafter during the term therein expressed should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN THE DEODORIZATION OF EXCRETA AND IN THE MANUFACTURE
20 OF MANURES THEREFROM," upon the condition (amongst others) that I, the said Henry Young Darracott Scott, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and
25 cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Henry Young Darracott Scott, do hereby declare the nature of my said Invention, and in what manner
30 the same is to be performed, to be particularly described and ascertained in and by the following statement (that is to say) :—

The object of this Invention is the prevention of nuisance in dealing with night soil and urinous liquids, and the fixation of their fertilizing elements, so as to render them valuable marketable commodities.

35 In carrying out my Invention with night soil I separate the solids from the liquids, and I use such substances as charcoal, dried earth,

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dried or scorched sewage deposit, sawdust, town ashes, road scrapings, and other substances of the same class for deodorizing the solids, and I extract the phosphoric acid and nitrogen present in the liquids by means of compounds, such as lime and hydrated phosphate of magnesia, in the manner herein-after set forth.

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For the charcoal I prefer to use charcoal made out of sewage deposit, and for lime I prefer to use that which is prepared from pure limestone, but it may be sometimes convenient to employ other descriptions of charcoal and lime, and I sometimes also substitute magnesia or dolomitic lime for lime.

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I am aware that charcoal and the other substances mentioned have already been used for deodorizing night soil, and that alkaline earths have been employed for the treatment of such matters and the decomposition of nitrogenous substances (as, for instance, by one Gavin Chapman, as described in the Specification of Letters Patent dated 15 twentieth October One thousand eight hundred and sixty-eight, No. 3203) as well as for precipitating liquid sewage, and that hydrated phosphate of magnesia has been proposed as a means for recovering ammonia from urinous and ammoniacal liquids, amongst others by myself, under Letters Patent dated twentieth March One thousand eight hundred 20 and seventy-two, No. 849. I therefore make no claim for the use of any of these substances simply as such, nor do I claim for the use of lime in conjunction with charcoal as purifying and deodorizing agents, unless employed substantially in the special manner or manners herein-after described.

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My present Invention consists essentially of novel combinations in the use of the above-mentioned substances, and of novel modes of applying them to the treatment of night soil and urinous liquids which are received into cesspools and other like receptacles, or after removal therefrom.

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In carrying out the process in cesspools and other receptacles of night soil, the charcoal or other equivalent deodorant may be applied occasionally through the fronts of the seats or otherwise, or it may be applied by well known mechanical arrangements which discharge a certain amount of the deodorant after each use of the privy or closet; but such 35 use of deodorant may be dispensed with, and the liquids be separated from the solids by merely straining through a screen. The liquids which

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drain off from the deodorants or the solid fœces are caused to traverse filtering media consisting of layers of lime and of hydrated phosphate of magnesia, and where great purity is required the liquids to be cleansed are also passed through filters of charcoal. The lime in such filters will
5 retain the phosphoric acid present in the soluble form, and will also decompose the urea of the urine, and at the same time produce ammonia, which is then fixed by passing the urine through filters of hydrated phosphate of magnesia in the form of ammoniacal phosphates. Any phosphoric acid remaining in solution in the liquid (which passes
10 through the filter of phosphate of magnesia) is to be fixed by a second filter of lime.

In cases in which the flow of urinous or ammoniacal liquid is rapid (as, for instance, in cases in which the urine from several blocks of houses is led to one point for treatment, and in public urinals) I employ
15 a series of such filters of lime and hydrated phosphate of magnesia.

One mode of applying my Invention to single cesspools or middens is as follows:—I form in or adjoining the cesspool a chamber, into and through which the liquids can flow off into the drains after passing through filters of the before-mentioned substances, while the solid fœces
20 remain behind. The bottom of this chamber is provided with a catch pit to allow of the settlement of any of the precipitated fertilizing matters which escape retention by the filters.

The direction of the filtration may be either upwards or downwards, or may pass through the filters horizontally placed in series, and so arranged
25 that the overflow of supernatant liquid from one filter may pass into the next, and so on. Supposing upward filtration to be the plan to be followed I commence by placing at the bottom of the chamber, or at some distance from it, as may be most convenient, a layer of charcoal (*a*); over or adjoining this I place a layer of lime (*b*); over or adjoining the lime
30 filter a layer of hydrated phosphate of magnesia (*c*), and over or adjoining the phosphate of magnesia a layer of lime (*d*); over or adjoining the layer (*d*) another layer of charcoal (*e*).

If the filters are arranged horizontally in series the clear supernatant liquid from one tank or filter vessel flows through a channel to the bottom
35 of the next; but if they are arranged vertically one over the other I prefer to separate the different layers by cocoa-nut matting, horse-hair cloth, or other suitable material confined at the edges in frames of

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galvanized iron. The galvanized iron frame should fit the chamber pretty accurately, and can be supported on "sets-off" provided in its construction. It is not however absolutely necessary to separate the layers of filtering substance in this manner, although it will be found convenient to do so when the phosphate of magnesia is to be recovered 5 in order that it may be used to deal with a fresh quantity of urine. The urinous liquids, after passing through such a system of filters, will flow into the drains in a comparatively pure and innoxious condition. The quantities of the chemicals used will depend on the number of persons using the cesspools, the frequency with which they are emptied, and the 10 occupation of the people. If employed out of doors manifestly less urine will find its way into the cesspools, as during the day it will be chiefly voided in the fields. The proportion of phosphates and urea in the urine is also much influenced by the character of the food of a population. It will be necessary, therefore, that the time which should be allowed to 15 elapse before the renewal of the lime and phosphate of magnesia and the charcoal should be a matter for observation in each case.

In an average case a cesspool for ten persons might require from five pounds to ten pounds of lime per month if the urine is stale, and from fifteen pounds to twenty pounds of lime per month if the urine is fresh, and 20 from seventy-five pounds to one hundred pounds of hydrated phosphate of magnesia but the quantity of these chemicals required to effect the purpose of my Invention will manifestly depend on the chemical composition of the lime used as well as on the richness or otherwise of the excreta to be dealt with, I therefore do not bind myself to the above proportions. 25 The charcoal or other deodorant of the solid fœces is also manifestly dependent on the character of the substance, and must be determined by actual trial. When the cesspool is emptied the different layers may be kept distinct, or if the free lime or magnesia which may happen to remain is first neutralized the layers may all be mixed together. The 30 action of free alkaline earths tends as is well known to the expulsion of ammonia from its combinations. In large towns it is more economical to deal with the layer of ammoniacal phosphate of magnesia separately, and (by well known methods) to expel its ammonia and re-employ the recovered phosphate of magnesia for dealing with a fresh portion of 35 ammoniacal liquid. In cases in which the cesspools are very large the liquids drain from them slowly, and they are only emptied at long intervals. The omission of the filter of lime (*d*) is of less importance,

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as much of the urine will have passed into decomposition spontaneously before it reaches the layer of phosphate of magnesia, and in some cases I provide a chamber of sufficient capacity to enable the urine to decompose before it reaches the filter of phosphate of magnesia, and then
5 dispense altogether with the lime filter (*d*). The filter of lime (*b*) will extract the phosphoric acid of the soluble phosphates which pass through as well as those which are dissolved out from the layer of phosphate of magnesia (*c*).

It is of considerable advantage to make the lime filters in two or more
10 divisions, and in the first of these divisions (or that through which the urine first passes) to employ lime which has been already partly exhausted in the second and third divisions, and to replace what is removed from the latter with fresh lime. The whole of the lime may finally be fully exhausted in the first division of filter (*d*). By this means
15 the lime in the first division of filter (*d*) can be brought to a degree of richness in phosphoric acid and nitrogen compounds, which will render it a highly valuable commodity, and promote the decomposition of the urine which passes through it.

In many cases in which the more perfect arrangements above
20 described are considered as inapplicable in consequence of the trifling amount of urine to be dealt with, the filter of phosphate of magnesia may be dispensed with. The contents of the second lime filter are brought forward to the first as soon as they have become about two thirds exhausted, and the second filter is refilled with fresh lime. The
25 second filter in this case breaks up the nitrogenous compounds and allows the effluent to become charged with lime which preserves it in an innoxious condition, and the carbonate of lime left in the filter is again decomposed when removed to the first filter by the phosphoric acid in the urine.

30 In dealing with excreta (when removed from the cesspools to a dépôt to be there treated) the use of the double lime filter previous to passing the liquid through the phosphate of magnesia filter is specially advantageous, and indeed this process (which I consider to be novel) is a very useful preparation for the subsequent treatment of liquids which are
35 rich in ammoniacal compounds by the process described by me under Letters Patent, dated Twentieth March One thousand eight hundred and seventy-two, No. 849, or in any other way.

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Although I consider the plan above described is best for dealing with single cesspools it is not essential that a distinct chamber should be made for the filters, nor that the materials should be applied as filters for stirring in excessive quantities of the chemicals as compared with the amounts of the compounds to be removed from solution would 5 manifestly produce analogous results. In either case the liquid would leave the last lime filter saturated with free lime which will produce valuable effects in cleansing the sewers into which it ultimately finds its way. The process of stirring is however only applicable when dealing with urine at a depôt. 10

It will be sufficient in dealing with single cesspools to spread the different layers of filtering material one over the other on the bottom of the cesspool, and to protect each layer by cocoa-nut matting or canvas if it be considered desirable to keep the chemicals separate. On the upper layer is placed a perforated metallic or other screen to protect it from 15 the shovels of the workmen when removing the solid fœces. In cases in which the liquids cannot pass off into the sewers, a supplementary cesspool may be attached to the chamber into which the liquids can be drained after passing through the said filtering media. From this cesspool the liquids (which after passing through the filtering media will 20 be comparatively pure) can be pumped at intervals into the nearest sewer or watercourse.

When the system is followed of collecting the night soil and conveying it to a depôt to be there converted into a portable manure, some modifications may with advantage be introduced into the mode of 25 procedure. If the collection from the cesspools and urinals is made without any special treatment with absorbents, I prefer that those closets shall be used which provide for the separation of the liquids from the solids. The solids I deodorize and dry by mixing with them dried sewage deposit or other absorbent, such as charcoal or road 30 scrapings. In the subsequent treatment of the liquids (in lieu of at once passing it through the filters of lime and hydrated phosphate of magnesia and charcoal, as in the case of night soil and urinous liquids in single cesspools, or proceeding as in the before mentioned Letters Patent, dated Twentieth March One thousand eight hundred and 35 seventy-two, No. 849, which was specially applicable to very dilute urinous solutions), I first remove the phosphoric acid of the soluble phosphates by adding to the liquid so much milk of lime as is necessary

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for its precipitation. Other matters of organic origin will also be separated by the action of the lime. The precipitated phosphates and organic matters thus obtained will form a valuable manure, and I find it advantageous to continue to stir the precipitate thus formed with the
5 liquid at intervals for a considerable time. I then proceed to the filtration processes. I arrange the filters with spaces between them in order that the chemicals used in them may be stirred up at intervals, which may be done by mechanical means. I prefer to use a succession of filters of phosphate of magnesia, say three or four instead of one deep
10 one, so that I can gradually move back the materials (the lime and phosphate of magnesia) as they gain in phosphoric acid and ammonia, and by this means I secure the more complete action of the chemicals employed, the most saturated being subjected to the strongest solutions.

If filtering fabrics are used to support the phosphate of magnesia
15 there is a tendency to the formation of crystals of ammoniacal magnesian phosphate in their pores, and thus the proper filtration of the liquids is impeded. It is of advantage therefore to wash these fabrics at intervals with an acid solution.

By a special arrangement of privy drains the drainage from several
20 houses may be conducted to one point before discharge into the main sewers, and a filtering apparatus composed of two or more separate sets of filters of the before mentioned substances may be there placed, and be so arranged as to be readily visited for the purpose of stirring or rearranging the filters as they become saturated, or for removing the
25 chemicals after they have done their duty. In this case and also in the case of public urinals it is easy to arrange for periodical flushings without interfering with the filters. To accomplish this it is merely necessary to provide means for shutting the channel through the filters, and opening another subsidiary channel to carry off the water, or to
30 make the filters themselves easily removeable. Similar arrangements can be made for cases in which closets are used which are flushed at intervals, or in which waterclosets are supplied with a limited and regulated quantity of water. With a view also of keeping the urinals sweet I pass a small quantity of milk of lime down the pipe for the
35 urine at intervals, as may be required.

In all these cases the charcoal may be mixed with the lime and phosphate of magnesia without departing from the nature of my Invention, but I prefer to follow the plan above described, which gives compounds

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having a higher value than when the charcoal is mixed with the lime or other chemical agents. Lime and phosphate of magnesia may be mixed together and used in one filter, but no advantage will be obtained over the plan I have already described.

Having now described my Invention of "Improvements in the 5 Deodorization of Excreta, and in the Manufacture of Manures therefrom," and having explained the means whereby the same may be carried into effect, I wish it to be understood that under the above in part recited Letters Patent I claim as new, deodorizing excreta in cesspools or other analagous receptacles, or after their removal there- 10 from, and the extraction of the fertilizing elements of such excreta by the treatment of their liquid portions (when separated from the solid matters) with lime or magnesia, or the two combined, and hydrated phosphate of magnesia, in the manner and for the purposes herein set forth. 15

In witness whereof, I, the said Henry Young Darracott Scott, have hereunto set my hand and seal, the Ninth day of August, in the year of our Lord One thousand eight hundred and seventy-three.

HENRY Y. D. SCOTT. (L.S.) 20

LONDON:

Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1873.

